

**Sizing of package
sewage treatment
plants**

15

**Issue 02.00
October 2019**

**Drainage:
Dwellings**



Building Control Alliance

Purpose | BCA Technical Guidance Note 15

BCA technical guidance notes are for the benefit of it's members and the construction industry, to provide information, promote good practice and encourage consistency of interpretation for the benefit of our clients. They are advisory in nature, and in all cases the responsibility for determining compliance with the Building Regulations remains with the building control body concerned.

This guidance note is based upon information available at the time of issue and may be subject to change. The Approved Documents should be consulted for full details in any particular case.

Status | BCA Technical Guidance Note 15[illegible]

Notes on issue status:

A minor amendment is issued as an incremental point on the original and is in the form of 15.01.01, where the first number is the TGN number, the second is the issue and the third is the minor revision to the issue.

A major rework or change in guidance is given a new issue number, this would be in the form of 15.02.00 for a full re-issue.

Minor revisions are issued retaining the main issue number with a sequential revision number, this would be for updating standards or correction of errors. This would be in the form of 15.01 **01** for the first minor revision to the first issue

Always ensure you are using the most recent Guidance Note, these can be referenced at the BCA website:

Conventions used within this document:

- Websites and links are shown in dark **blue underlined bold text**.
- Standards and referenced documents are shown in **bold text**.
- Defined terms within the glossary are shown in **light blue bold text**.
- Section and diagram references are shown in **purple text**.



Introduction | BCA Technical Guidance Note 15

Part H1 of the Building Regulations 2010 requires that an adequate system of drainage should be provided to carry all foul water from a building to a range of outlets which are set in order of priority –

- A public sewer
- A private sewer connecting to a public sewer
- A septic tank which has an appropriate form of secondary treatment or another wastewater treatment system
- A cesspool

This guidance note provides information to assist in the sizing of self-contained **package sewage treatment plants** for multi-occupancy sites where no connection to either a foul or private sewer is possible.

Key Issues | BCA Technical Guidance Note 15

It is important to size **package sewage treatment plant** correctly in order for it to function efficiently.

Manufacturers of **package sewage treatment plants** helpfully provide an indication of the population size that each individual unit will serve. However, these figures are for indicative purposes only and each unit should be designed on an individual basis depending on the particular characteristics of the scheme.

Information on sizing can be found in the British Water Code of Practice Flows and Loads – 4, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems (**BW-COP**).

This document is available for download from:

<https://www.britishwater.co.uk/Publications/codes-of-practise.aspx>

The use of the **BW-COP** will help promote the design and installation of appropriately sized sewage treatment systems and reduce the problems associated with undersized systems causing environmental contamination.

Where the design population exceeds 50 persons, **BCB**'s will require that the design of the **package sewage treatment plant** should be carried out by a suitably qualified engineer.

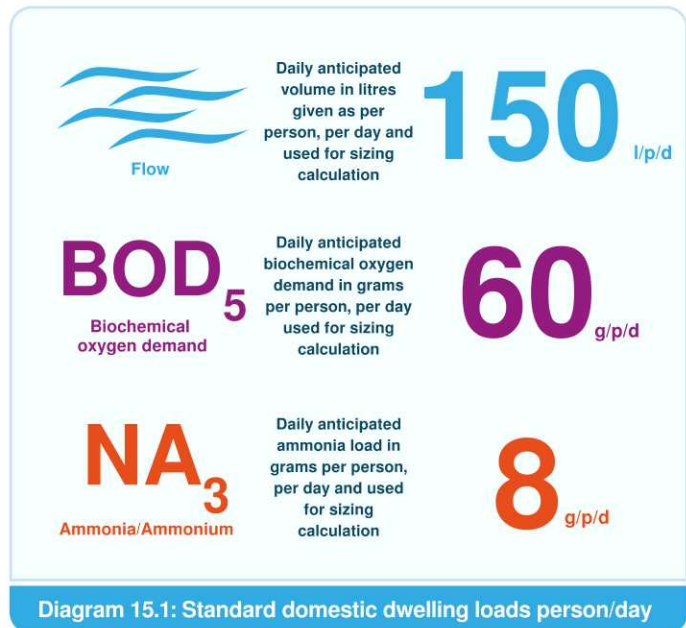
Design Loadings

BW-COP contains a table of loadings that apply to domestic dwellings, with criteria given for:

- flow (litres)
- biochemical oxygen demand (BOD) (grams)
- Ammonia (Grams)

The loading values given for standard domestic residential developments are as shown in **diagram 15.1** (right).

In order to determine the correct size of sewage treatment plant, the **design population (P)** first needs to be calculated.



Sizing

The criteria given in **BW-COP** to determine the design population (P) for new and existing dwellings is shown in **diagram 15.2** below:



The principle of calculation for dwellings with one, two or three bedrooms is a minimum **design population (P)** of five people, or **5P**.

For dwellings with four or more bedrooms, the **design population (P)** is calculated as five people plus one person for each bedroom over 3 and therefore:

If the number of Bedrooms is greater than three:

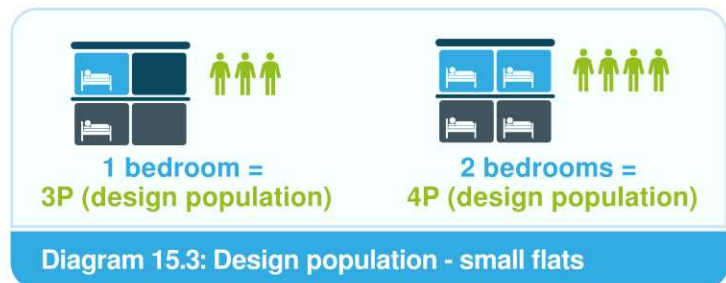
$$P = N_B + 2$$

Where:

P = Design Population

N_B = Number of Bedrooms

For small flats, a variation on this can be applied where one or two bedrooms are provided. The **design population** for one bedroom is three and for two bedrooms is four as illustrated in **diagram 15.3** right.



For **flats**, where the number of bedrooms is three or more, the formula given above should be used, ie:

If the number of Bedrooms is three or greater:

$$P = N_B + 2$$

Where:

P = Design Population

N_B = Number of Bedrooms

Groups of houses

Where a **treatment plant** is designed to serve more than one house, the **design population (P)** for each individual house should be used, as demonstrated in **example 15.1a** and **15.1b** below.

Example 15.1: Groups of dwellings

Example 15.1a: Two dwellings

A group of two houses, one with three bedrooms and the other with four bedrooms would have **design populations** of **5P** and **6P** respectively. Therefore, a **treatment plant** that is to serve both of these houses, would need the individual **design population** of each added together to give **11P**, so:



Example 15.1b: Three flats

A block of three flats, one with one bedroom and the other two with two bedrooms each would have **design populations** of **3P** and **8P** (2x4P) respectively. Therefore, a treatment plant that is to serve the block would need the individual **design population** of each added together to give **11P**:



4P + 4P + 3P = 11P Treatment Plant, or:



Variations where the design population exceeds 12P

Some reduction may be made to allow for the balancing effects on daily flow from a group of houses:

Design population (P) of 13P upto, and including 25P

For a **design population** value of **13P** upto, and including **25P**, the total can be multiplied by **0.9**. This figure must always be rounded up to the nearest whole value.

$$\begin{array}{c} 13 \\ \downarrow \\ 25 \end{array} = P \times 0.9$$

Design population (P) of 26P upto, and including 50P

For a **design population** value of **26P** upto, and including **50P**, the total can be multiplied by **0.8**. This figure must always be rounded up to the nearest whole value.

$$\begin{array}{c} 26 \\ \downarrow \\ 50 \end{array} = P \times 0.8$$

Example 15.2: Design population 13-25P

For example, 4 x 4 bedroom houses would be $4 \times 6P = 24P$

As this is between 13 and 25, this can be multiplied by **0.9** which would give **21.6P**, therefore the next highest whole value is **22P**.

Example 15.3: Design population 26-50P

For example, 4 x 5 bedroom houses would be $4 \times 7P = 28P$

As this is between 26 and 50, this can be multiplied by **0.8** which would give **22.4P**, therefore the next highest whole value is **23P**.

The figures in **table 15.1** below give permissible population values for those up to **50P** with modified values for **design populations (P)** between 13 and 50

3

12

NOTE: The modified values must always be taken as the next highest whole number. They must never be reduced.

Table 15.1: Calculated design population values (P) with calculated modified population values

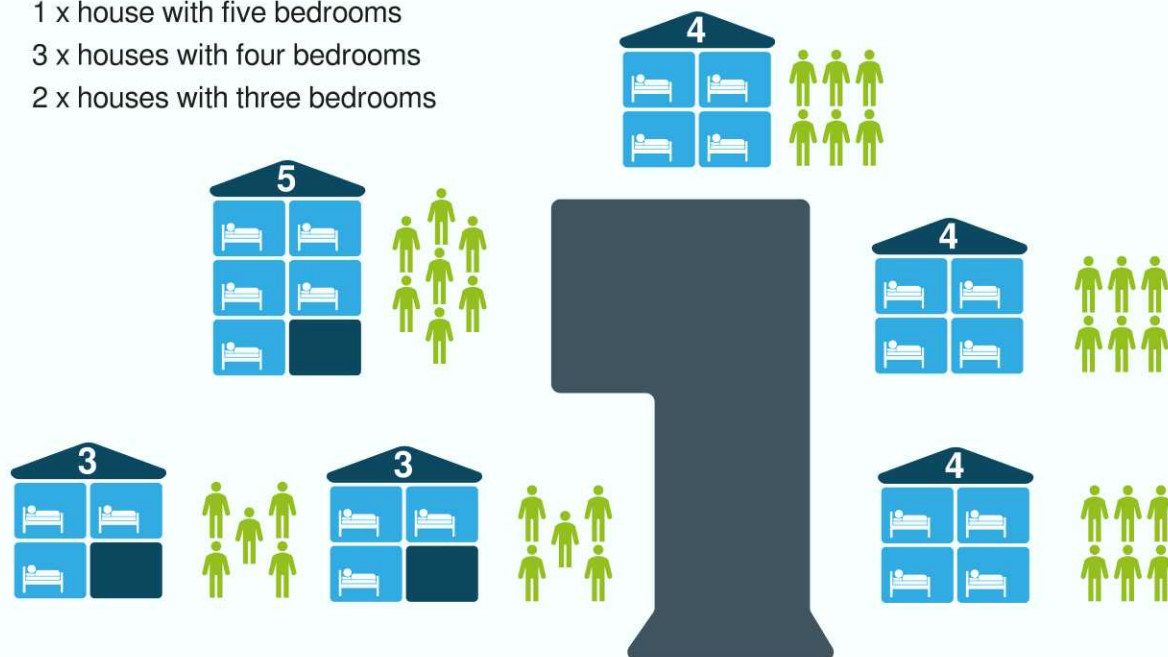
Design populations over 51P

Where the **design population** is **51P** or over, the **packaged sewage treatment plant** must be designed by a qualified engineer.

Example 15.4: Groups of dwellings

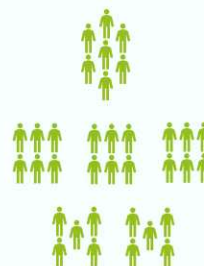
Consider a residential development of 6 houses, comprising:

- 1 x house with five bedrooms
- 3 x houses with four bedrooms
- 2 x houses with three bedrooms



Using the guidance given, this gives:

- 1 x house with five bedrooms, design population = **7P**
- 3 x houses with four bedrooms, design population = $3 \times 6P = 18P$
- 2 x houses with three bedrooms = $2 \times 5P = 10P$



Therefore the total is **7P + 18P + 10P = 35P**

35P is within the range **26-50P** and therefore a modification factor can be applied of $\times 0.8$, reading from the 0.8 table given, the result is a modified value of **28P** (This is also given by 35×0.8).

This modified design population is then multiplied by values given in the table of **BW-COP** to determine the correct size sewage **treatment plant**, details of which can be obtained from the manufacturer.

For this example, a treatment plant capable of the following loads per day would be needed:

 **150** l/p/d

150 x 28 =
4200 litres per day

BOD₅ **60** g/p/d
Biochemical oxygen demand

60 x 28 =
1680 grams per day

NA₃ **8** g/p/d
Ammonia/Ammonium

8 x 28 =
224 grams per day

Sizing of package sewage treatment plants

When specifying and choosing a sewage **treatment plant** the above values should be checked with the manufacturer to ensure the **package treatment plant** chosen can meet the total predicted flows and loads. Manufacturers and many specialist suppliers offer technical advice including advice on **design population**, flows, loads and **package sewage treatment plant** sizing. It is recommended that this advice is sought when **package sewage treatment plants** are being specified for individual developments.

The above **BW-COP** guidance is considered helpful in determining a check of **package sewage treatment plant** sizing and is considered the minimum information that a **Building Control Body** is likely to expect to be provided to justify **package sewage treatment plant** where they are proposed on residential developments.

Final discharge from a package sewage treatment plant

In addition to the correct sizing of **package sewage treatment plant**, careful consideration also needs to be given to the final discharge from the plant which may be to a properly designed, sited and sized drainage field. Many small installations will fulfill the **general binding rules** (issued by **DEFRA** in 2015) and therefore it is likely that consent from the **Environment Agency (EA)** will not be required, however installations will still require a submission for Building Regulations and advice can be sought from your **Building Control Body**. The **general binding rules** are available for review at:

<https://www.gov.uk/government/publications/small-sewage-discharges-in-england-general-binding-rules>

If the installation will not be in accordance with the **general binding rules**, consent from the **EA** will be required and the **EA** should always be consulted before commencing with works.

A check should always be made of any restrictions made by the **EA** and the local planning authority.

The exact area of land required for the drainage field will be determined by a percolation test. A competent person should carry this out.

Where a drainage field cannot be used, it may be possible to discharge to a watercourse, coastal waters or to a surface water sewer. The receiving waters must be able to dilute the effluent so that it does not harm the environment. Discharges to surface water are permitted by the **general binding rules**, however if the installation will not be in compliance with the rules, written consent of the **EA** will be required.

If it is proposed to discharge to a surface water sewer, it is likely that the consent of the sewer provider will be required, normally the local water authority.

Where consent from the **EA** is required, they will usually set quality and volume limits. It is important to seek advice from the **EA** on the likely effluent quality standard required before ordering the plant so that assurances can be obtained from the manufacturer to confirm the plant will comply with these standards.

The **BCB** will require a copy of the written consent from the **EA** for the discharge arrangements, or will need to be satisfied that the **general binding rules** are achieved where a **package sewage treatment plant** is required.

Further Information | BCA Technical Guidance Note 15

Further information on discharge from sewage **treatment plant** can be found on the HM Government website at:

<https://www.gov.uk/guidance/general-binding-rules-small-sewage-discharge-to-the-ground>

and

<https://www.gov.uk/guidance/general-binding-rules-small-sewage-discharge-to-the-ground#rules-for-existing-and-new-discharges>

Further guidance on siting of **package sewage treatment plant** and design/siting of drainage fields can be found in Section H2 of **Approved Document H** available for download from:

<https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h>

Glossary of Terms | BCA Technical Guidance Note 09

BCB or Building Control Body

Building Control Body; the organisation responsible for providing building regulation compliance services, either within Local Authority or private sector Approved Inspector.

DEFRA

HM Government, Department for Environment, Food and Rural Affairs.

Design Population

Number of people the system is intended to serve in accordance with **BW-COP**, indicated by (P) in text.

General Binding Rules

Rules issued by **DEFRA** for discharges to the ground or surface water of treated sewage, compliance with these rules will mean that consent for a discharge is not required from the **Environment Agency**.

Environment Agency or EA

An executive non-departmental public body, sponsored by **DEFRA** and responsible for regulating major industry, waste, treatment of contaminated land, water quality/resources, fisheries, inland river, estuary and harbour navigations, and conservation/ecology.

Requirement H1 or Part H1

Requirement H1 of Schedule 1 to the Building Regulations 2010, foul water drainage.

Package sewage treatment plant or treatment plant

A range of systems engineered to treat a given hydraulic and organic load using prefabricated components which can be installed with minimal site work. They use a number of processes which are different in detail, all treat effluent to a higher standard than septic tank systems and this normally allows direct discharge to a watercourse.

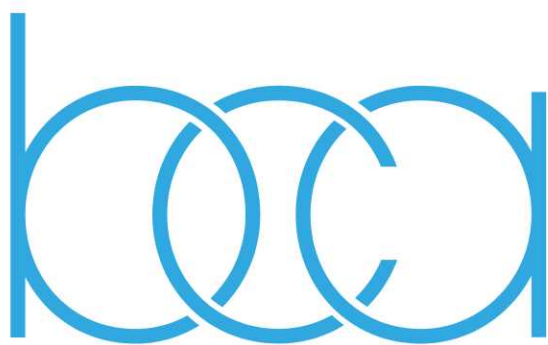
References | BCA Technical Guidance Note 09

Approved Document H

HM Government (2015) Approved Document H - Drainage and waste disposal: 2015 Edition. Newcastle-upon-Tyne: NBS. Also Available from www.gov.uk.

BW-COP

British Water (2013) Code of Practice Flows and Loads – 4, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems (BW-COP: 18.11/13). ISBN: 978-1-903481-10-3. Available from www.britishwater.co.uk



Building Control Alliance

The Building Control Alliance is a unique industry group made up of representatives from clients, stakeholders and all the organisations directly involved in building control in England and Wales.

It includes the organisations supporting the many thousands of building control professionals –

- Chartered Institute of Building
- Chartered Association of Building Engineers
- Royal Institution of Chartered Surveyors

and the professional associations promoting public and private sector building control –

- Local Authority Building Control
- Association of Consultant Approved Inspectors.



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